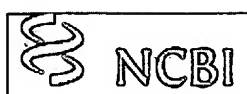


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1: J Org Chem. 2003 Aug 22;68(17):6611-8.

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**Photochemical access to tetra- and pentacyclic terpene-like products from R-(+)-sclareolide.****de la Torre MC, Garcia I, Sierra MA.**

Instituto de Quimica Organica, Consejo Superior de Investigaciones Cientificas (CSIC), Juan de la Cierva 3, 28006-Madrid, Spain.

Fused tetracyclic oxetanes 4, highly substituted cyclobutenes 6, and the pentacyclic derivatives 7 and 8 were obtained by irradiation of derivatives 3 that were prepared from commercial R-(+)-sclareolide (1) in three steps. Compounds 4 are formed through a Paterno-Buchi reaction, while tricyclic derivatives 6 are the fragmentation products of the first formed oxetanes. In clear contrast, cyclopentenyl and 3-furyl derivatives, 3e and 3f, gave the [2+2] adducts, namely pentacyclic derivatives 7 and 8. All the reported reactions are totally regio- and stereoselective, with the exception of the cyclization of furyl derivative 3f, which gave the mixture of both the crossed (7b) and the right (8) isomers.

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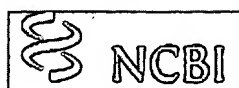
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








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# INTRODUCTION TO ORGANIC CHEMISTRY

FOURTH EDITION

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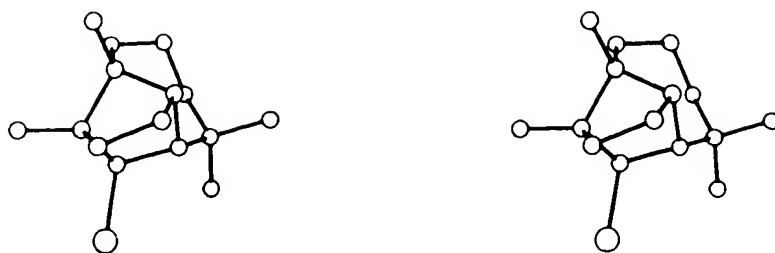
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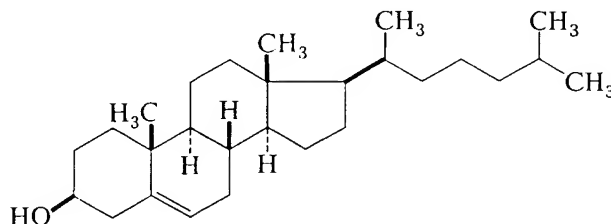
**FIGURE 36.4** Stereo structure of longifolene hydrochloride. Note that hydrogens are not shown. [Reproduced with permission from *Molecular Structure and Dimensions*, International Union of Crystallography, 1972.]

Synthetic routes to the simpler terpenes are now available, but many of the more complex polycyclic terpenes provide synthetic challenges that intrigue present-day synthetic research chemists.

**EXERCISE 36.14** Locate the isoprene units in menthol,  $\beta$ -pinene, camphor,  $\beta$ -santalol, copaene, guaiol, abietic acid,  $\beta$ -amyrin, and longifolene. Note that nootkatone cannot be dissected into three isoprene units. In fact, it has been shown that this sesquiterpene is biosynthesized by a route that involves a 1,2-alkyl rearrangement.

## B. Steroids

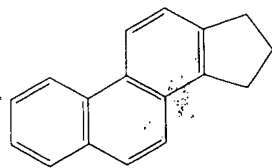
**Steroids** are tetracyclic natural products that are related to the terpenes in that they are biosynthesized by a similar route. An important example is cholesterol, the major component of human gall stones (Gk., *chole*, bile).



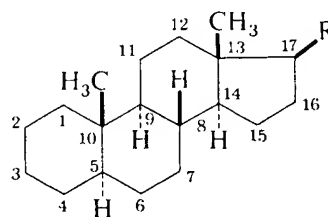
cholesterol

Actually, cholesterol is present in some amount in all normal animal tissues, but it is concentrated in the brain and in the spinal cord. The total amount present in a 180 lb person is 240 g, about 0.5 lb! It is present partly as the free alcohol and partly esterified with fatty acids.

The structure of cholesterol illustrates the basic steroid skeleton, which is that of a hydrogenated 1,2-cyclopentenophenanthrene having two methyl substituents at C-10 and C-13 and an additional side chain at C-17. The stereochemistry at the various stereocenters is almost invariably that shown, and in subsequent examples we will not indicate stereochemistry unless it differs from the usual.



1,2-cyclopentenophenanthrene



general steroid ring structure